Fixed-Mounted Circuit-Breaker Switchgear
Type NXPLUS up to 40.5 kV, Gas-Insulated

Medium-Voltage Switchgear

Totally Integrated Power – NXPLUS
Application
Public power supply system

Application
Offshore wind park

Application
Steel works
Fixed-Mounted Circuit-Breaker Switchgear 
Type NXPLUS up to 40.5 kV, Gas-Insulated 
Medium-Voltage Switchgear 
Catalog HA 35.51 · 2015 
www.siemens.com/medium-voltage-switchgear

The products and systems described in this catalog are manufactured and sold according to a certified management system (acc. to ISO 9001, ISO 14001 and BS OHSAS 18001).
Types

Application

Panel for single busbar

Panel for double busbar
Fixed-mounted circuit-breaker switchgear NXPLUS is a factory-assembled, type-tested, metal-enclosed, SF₆-insulated switchgear with metallic partitions ²) for single-busbar and double-busbar applications for indoor installation.

It is used in transformer and switching substations, e.g., in:
- Power supply companies
- Power stations
- Cement industry
- Automobile industry
- Iron and steel works
- Rolling mills
- Textile, paper and food industries
- Chemical industry
- Petroleum industry
- Pipeline installations
- Electrochemical plants
- Petrochemical plants
- Diesel power plants
- Emergency power supply installations
- Traction power supply systems.

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### Electrical data (maximum values) and dimensions

#### Single-busbar panels

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage max. kV</td>
<td>12 24 36 40.5</td>
</tr>
<tr>
<td>Rated frequency Hz</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage kV</td>
<td>28 50 70 85</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>75 125 170 185</td>
</tr>
<tr>
<td>Rated short-circuit breaking current max. kA</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated short-time withstand current, 3 s max. kA</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated short-circuit making current max. kA</td>
<td>80/82</td>
</tr>
<tr>
<td>Rated peak withstand current max. kA</td>
<td>80/82</td>
</tr>
</tbody>
</table>

#### Double-busbar panels

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage max. kV</td>
<td>12 24 36 40.5</td>
</tr>
<tr>
<td>Rated frequency Hz</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage kV</td>
<td>28 50 70</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>75 125 170</td>
</tr>
<tr>
<td>Rated short-circuit breaking current max. kA</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated short-time withstand current, 3 s max. kA</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated short-circuit making current max. kA</td>
<td>80/82</td>
</tr>
<tr>
<td>Rated peak withstand current max. kA</td>
<td>80/82</td>
</tr>
<tr>
<td>Rated normal current of the busbar max. A</td>
<td>2500</td>
</tr>
<tr>
<td>Rated normal current of the feeders max. A</td>
<td>2500</td>
</tr>
</tbody>
</table>

---

1) 2500 A on request
2) Corresponds to “metal-clad” according to former standard IEC 60298
Requirements

Features

Environmental independence
Hermetically tight, welded switchgear vessels made of stainless steel as well as single-pole solid insulation make the parts of the primary circuit under high voltage of NXPLUS switchgear

• Insensitive to certain aggressive ambient conditions, such as:
  – Air humidity
  – Dust
  – Condensation
• Tight to ingress of foreign objects, such as:
  – Dust
  – Pollution
  – Small animals
  – Humidity
• Independent of the site altitude.

Compact design
Thanks to the use of SF₆ insulation, compact dimensions are possible up to 40.5 kV.
Thus:
• Existing switchgear rooms and substation rooms can be used effectively
• New constructions cost little
• Costly city-area space is saved.

Maintenance-free design
Switchgear vessels designed as sealed pressure systems, maintenance-free switching devices and enclosed cable plugs ensure:
• Maximum supply reliability
• Personnel safety
• Sealed-for-life design according to IEC 62271-200 (sealed pressure system)
• Installation, operation, extension and replacement without SF₆ gas work
• Reduced operating costs
• Cost-efficient investment
• No maintenance cycles.

Innovation
The use of digital secondary systems and combined protection and control devices ensures:
• Clear integration in process control systems
• Flexible and highly simplified adaptation to new system conditions and thus to cost-efficient operation.

Service life
Under normal operating conditions, the expected service life of gas-insulated switchgear NXPLUS is at least 35 years, probably 40 to 50 years, taking the tightness of the hermetically welded switchgear vessel into account. The service life is limited by the maximum number of operating cycles of the switchgear devices installed:
• For circuit-breakers, according to the endurance class defined in IEC 62271-100
• For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102.

Safety

Personal safety
• Safe-to-touch and hermetically sealed primary enclosure
• Cable terminations, busbars and voltage transformers are surrounded by earthed layers
• All high-voltage parts including the cable terminations, busbars and voltage transformers are metal-enclosed
• Capacitive voltage detecting system to verify safe isolation from supply
• Operating mechanisms and auxiliary switches safely accessible outside the primary enclosure (switchgear vessel)
• Due to the system design, operation is only possible with closed switchgear enclosure
• Standard degree of protection IP 65 for all high-voltage parts of the primary circuit, IP 3XD for the switchgear enclosure according to IEC 60529 and VDE 0470-1
• High resistance to internal arcs by logical mechanical interlocks and tested switchgear enclosure
• Panels tested for resistance to internal faults up to 31.5 kA
• Logical mechanical interlocks prevent maloperation
• Make-proof earthing by means of the vacuum circuit-breaker.

Security of operation
• Hermetically sealed primary enclosure independent of environmental effects (pollution, humidity and small animals)
• Maintenance-free in an indoor environment (IEC 62271-1 and VDE 0671-1)
• Operating mechanisms of switching devices accessible outside the primary enclosure (modules)
• Metal-coated or metal-enclosed, plug-in inductive voltage transformers mounted outside the SF₆ switchgear vessel
• Current transformers as ring-core current transformers mounted outside the SF₆ switchgear vessel
• Complete switchgear interlocking system with logical mechanical interlocks
• Welded switchgear vessels, sealed for life
• Minimum fire load
• Operating mechanisms of switching devices accessible outside the primary enclosure (modules)
• Metal-coated or metal-enclosed, plug-in inductive voltage transformers mounted outside the SF₆ switchgear vessel
• Current transformers as ring-core current transformers mounted outside the SF₆ switchgear vessel
• Complete switchgear interlocking system with logical mechanical interlocks
• Welded switchgear vessels, sealed for life
• Minimum fire load
• Type and routine-tested
• Standardized and manufactured using numerically controlled machines
• Quality assurance in accordance with DIN EN ISO 9001
• More than 500,000 switchgear panels of Siemens in operation worldwide for many years
• Option: Resistance against earthquakes (single busbar only).

Reliability
• Type and routine-tested
• Standardized and manufactured using numerically controlled machines
• Quality assurance in accordance with DIN EN ISO 9001
• More than 500,000 switchgear panels of Siemens in operation worldwide for many years.
Requirements

Technology

**General**
- 3-pole enclosure of the primary part via modules made of stainless steel
- Insulating gas SF₆
- Three-position switch as busbar disconnector and feeder earthing switch
- Make-proof earthing by means of the vacuum circuit-breaker
- Panel spacing of incoming and outgoing feeder panels: 600 mm (1200 mm as of 2300 A feeder current)
- Hermetically tight, welded switchgear vessel made of stainless steel
- 1-pole solid-insulated, screened module coupling in bolted technology
- Cable connection with inside-cone or outside-cone plug-in system, or for connection of solid-insulated bars
- Wall-standing or free-standing arrangement
- Cable connection access from front or rear
- Low-voltage door hinges on the left or on the right
- Installation and extension of existing switchgear at both ends without gas work and without modification of existing panels
- Panel-internal control cables in metallic wiring ducts.

**Interlocks**
- According to IEC 62271-200 and VDE 0671-200
- Logical mechanical interlocks prevent maloperation
- Three-position mechanical interlocks can only be operated with circuit-breaker in OPEN position
- Circuit-breaker can only be operated with three-position switch in end position and operating lever removed
- Three-position disconnector interlocked against the circuit-breaker in circuit-breaker panels and in bus sectionalizers with one panel spacing
- “Feeder earthed” locking device
- Locking device for three-position switch
  The following interlocks can be fulfilled by placing the padlock accordingly:
  - Padlock on the left:
    Three-position switch “DISCONNECTING” function cannot be operated, three-position switch “READY-TO-EARTH” function can be operated
  - Padlock in the center:
    Control gate blocked, no switching operations possible
  - Padlock on the right:
    Three-position switch “DISCONNECTING” function can be operated, three-position switch “READY-TO-EARTH” function cannot be operated
- Option: Cable compartment cover interlocked against the three-position switch (circuit-breaker panel, disconnector panel)
- Option: Electromagnetic interlocks
- Option: Actuating openings of the circuit-breaker can be padlocked
- Option: “Feeder” locking device.

**Modular design**
- Replacement of the circuit-breaker module without gas work
- Low-voltage compartment removable, plug-in bus wires.

**Instrument transformers**
- Can be removed without altering the position of the busbar and circuit-breaker modules (outside the gas compartments)
- Current transformers not subjected to dielectric stress
- Easy replacement of ring-core current transformers
- Metal-coated or metal-enclosed, plug-in and disconnectable voltage transformers.

**Vacuum circuit-breaker**
- Maintenance-free under normal ambient conditions according to IEC 62271-1 and VDE 0671-1
- No relubrication or readjustment
- Up to 10,000 operating cycles
- Vacuum-tight for life.

**Secondary systems**
- Customary protection, measuring and control equipment
- Option: Numerical multifunction protection relay with integrated protection, control, communication, operating and monitoring functions
- Can be integrated in process control systems.

**Standards**
(see page 59)
## Technical Data

### Electrical data, filling pressure, temperature for single-busbar switchgear

<table>
<thead>
<tr>
<th>Common electrical data, filling pressure and temperature</th>
<th>Rated insulation level</th>
<th>Rated voltage ( U_r )</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage ( U_I ):</td>
<td>kV</td>
<td>28</td>
<td>50</td>
<td>70</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td>kV</td>
<td>32</td>
<td>60</td>
<td>80</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage ( U_I ):</td>
<td>kV</td>
<td>85</td>
<td>145</td>
<td>195</td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated frequency ( f_r )</td>
<td>Hz</td>
<td>50/60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated normal current ( I_n )</td>
<td>up to A</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Rated filling level ( p_{in} )</td>
<td>150 kPa (absolute) at 20 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum functional level ( p_{me} )</td>
<td>130 kPa (absolute) at 20 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient air temperature</td>
<td>–5 °C to +55 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Data of the switchgear panels

#### Circuit-breaker panel

<table>
<thead>
<tr>
<th>Outside cone 1250 A</th>
<th>Rated normal current ( I_n )</th>
<th>A</th>
<th>1250</th>
<th>1250</th>
<th>1250</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current ( I_k ) for switchgear with ( t_k = 3 ) s</td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current ( I_p ) 50/60 Hz</td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td>–/–</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current ( I_{ma} ) 50/60 Hz</td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td>–/–</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current ( I_{lc} )</td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Electrical endurance of vacuum circuit-breakers</td>
<td>at rated normal current</td>
<td>10,000 operating cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at rated short-circuit breaking current</td>
<td>50 breaking operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Circuit-breaker panel and bus sectionalizer

<table>
<thead>
<tr>
<th>Inside cone 1250 A 1600 A 2000 A</th>
<th>Rated normal current ( I_n )</th>
<th>A</th>
<th>1250</th>
<th>1250</th>
<th>1250</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current ( I_k ) for switchgear with ( t_k = 3 ) s</td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current ( I_p ) 50/60 Hz</td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current ( I_{ma} ) 50/60 Hz</td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit breaking current ( I_{lc} )</td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>Electrical endurance of vacuum circuit-breakers</td>
<td>at rated normal current</td>
<td>10,000 operating cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at rated short-circuit breaking current</td>
<td>50 breaking operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Disconnector panel

<table>
<thead>
<tr>
<th>Outside cone 1250 A</th>
<th>Rated normal current ( I_n )</th>
<th>A</th>
<th>1250</th>
<th>1250</th>
<th>1250</th>
<th>–</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current ( I_k ) for switchgear with ( t_k = 3 ) s</td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current ( I_p ) 50/60 Hz</td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
<td>–/–</td>
<td></td>
</tr>
</tbody>
</table>

1) 2500 A on request
2) The rated normal currents apply to ambient air temperatures of max. 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)
3) Pressure values for gas-insulated switchgear vessels
### Electrical data, filling pressure, temperature for double-busbar switchgear

#### Common electrical data, filling pressure and temperature

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$</th>
<th>$12$</th>
<th>$24$</th>
<th>$36$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$kV$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage $U_d$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td>$kV$</td>
<td>28</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>$kV$</td>
<td>32</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage $U_{Up}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td>$kV$</td>
<td>75</td>
<td>125</td>
<td>170</td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>$kV$</td>
<td>85</td>
<td>145</td>
<td>195</td>
</tr>
</tbody>
</table>

| Rated frequency $f_r$ | Hz | $50/60$ |

#### Data of the switchgear panels

<table>
<thead>
<tr>
<th>Circuit-breaker panel</th>
<th>Rated normal current $I_r$</th>
<th>A</th>
<th>$1250$</th>
<th>$1250$</th>
<th>$1250$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside cone 1250 A</td>
<td></td>
<td>A</td>
<td>1250</td>
<td>1250</td>
<td>1250</td>
</tr>
<tr>
<td>Inside cone</td>
<td></td>
<td>A</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>2300</td>
<td>2300</td>
<td>2300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit-breaker panel</th>
<th>Rated short-time withstand current $I_k$</th>
<th>up to kA</th>
<th>$31.5$</th>
<th>$31.5$</th>
<th>$31.5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside cone 1250 A</td>
<td></td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Inside cone</td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit-breaker panel</th>
<th>Rated short-circuit making current $I_{Sm}$</th>
<th>up to kA</th>
<th>$80/82$</th>
<th>$80/82$</th>
<th>$80/82$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside cone 1250 A</td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
<tr>
<td>Inside cone</td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit-breaker panel</th>
<th>Rated short-circuit breaking current $I_{Sc}$</th>
<th>up to kA</th>
<th>$31.5$</th>
<th>$31.5$</th>
<th>$31.5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside cone 1250 A</td>
<td></td>
<td>up to kA</td>
<td>31.5</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Inside cone</td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>up to kA</td>
<td>80/82</td>
<td>80/82</td>
<td>80/82</td>
</tr>
</tbody>
</table>

#### Technical Data

1) The rated normal currents apply to ambient air temperatures of max. 40 °C.
2) The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)
2) Pressure values for gas-insulated switchgear vessels
Room planning

Switchgear installation
- For single-busbar or double-busbar applications:
  - Wall-standing arrangement or
  - Free-standing arrangement
  - Face-to-face arrangement accordingly.

Room dimensions
See opposite dimension drawings.

Room height
- SBB ≥ 2950 mm
- DBB ≥ 3100 mm.

Door dimensions
The following dimensions are recommended as a minimum for the door dimensions:
- SBB
  - Door height: ≥ 2750 mm
  - Door width: ≥ 1200 mm
- DBB
  - Door height: ≥ 2900 mm
  - Door width: ≥ 1500 mm.

Switchgear fixing
- Floor openings and fixing points of the switchgear (see pages 12 to 21)
- Foundations:
  - Steel girder construction
  - Steel-reinforced concrete with foundation rails, welded or bolted on.

Panel dimensions
See pages 12 to 21.

Weights
Single-busbar panels
- 1200 kg.
Double-busbar panels
- 1800 kg.

Panel width B1 (spacing)
<table>
<thead>
<tr>
<th>Panel type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit-breaker panel</td>
<td>600 mm</td>
</tr>
<tr>
<td>Disconnector panel</td>
<td>600 mm</td>
</tr>
<tr>
<td>Bus sectionalizer panel</td>
<td>900 mm</td>
</tr>
</tbody>
</table>

Panel width B2 (spacing)
<table>
<thead>
<tr>
<th>Panel type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit-breaker panel 1</td>
<td>600 mm</td>
</tr>
<tr>
<td>Bus coupler panel</td>
<td>600 mm</td>
</tr>
<tr>
<td>Bus sectionalizer panel</td>
<td>600 mm</td>
</tr>
<tr>
<td>System 1 or system 2</td>
<td></td>
</tr>
<tr>
<td>Metering panel</td>
<td>300 mm or 600 mm</td>
</tr>
</tbody>
</table>

1) 1200 mm at 2300/2500 A
2) 900 mm or 1200 mm at 2300/2500 A

* Aisle width
** Free space next to the last panel installed, either on the left or on the right of the switchgear row
*** Recommendation ≥ 500 mm
## Transport

NXPLUS switchgear is delivered in form of individual panels. Please observe the following:
- Transport facilities on site
- Transport dimensions and transport weights
- Size of door openings in building.

## Packing

Means of transport:
- Rail and truck
  - Panels on pallets
  - Open packing with PE protective foil.
- Ship
  - Panels on pallets
  - In closed crates with sealed upper and lower PE protective foil
  - With desiccant bags
  - With sealed wooden base
  - Max. storage time: 6 months.

## Transport dimensions, transport weights

<table>
<thead>
<tr>
<th>Panel widths</th>
<th>Transport dimensions Width x Height x Depth</th>
<th>Transport weight with packing approx. kg</th>
<th>Transport weight without packing approx. kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm x mm x mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Single-busbar switchgear transport by rail or truck</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 × 600</td>
<td>1100 × 2680 (2850) 2100</td>
<td>1300</td>
<td>1200</td>
</tr>
<tr>
<td>1 × 900</td>
<td>1870 × 2680 (2850) 2100</td>
<td>1350</td>
<td>1200</td>
</tr>
</tbody>
</table>

| **Single-busbar switchgear transport by ship** |                                            |                                         |                                           |
| 1 × 600      | 1150 × 3000 × 2100                           | 1300                                    | 1200                                      |
| 1 × 900      | 1920 × 3000 × 2100                           | 1350                                    | 1200                                      |

| **Double-busbar switchgear transport by rail or truck** |                                            |                                         |                                           |
| 1 × 600      | 1100 × 2830 (2850) 2100                     | 1900                                    | 1800                                      |
| 1 × 900      | 1870 × 2830 (2850) 2100                     | 2000                                    | 1800                                      |
| 1 × 1200     | 1870 × 2830 (2850) 2100                     | 2000                                    | 1800                                      |

| **Double-busbar switchgear transport by ship** |                                            |                                         |                                           |
| 1 × 600      | 1150 × 3000 × 2100                           | 1900                                    | 1800                                      |
| 1 × 900      | 1920 × 3000 × 2100                           | 2000                                    | 1800                                      |
| 1 × 1200     | 1920 × 3000 × 2100                           | 2000                                    | 1800                                      |

## Classification of NXPLUS switchgear according to IEC 62271-200

### Design and construction

<table>
<thead>
<tr>
<th>Partition class</th>
<th>PM (metallic partition) 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of service continuity category</td>
<td>LSC 2</td>
</tr>
</tbody>
</table>

### Accessibility to compartments (enclosure)

<table>
<thead>
<tr>
<th>Busbar compartment</th>
<th>Tool-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching-device compartment</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Low-voltage compartment</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Cable compartment</td>
<td>Tool-based</td>
</tr>
</tbody>
</table>

### Internal arc classification

<table>
<thead>
<tr>
<th>Designation of the internal arc classification IAC</th>
<th>IAC A FL 31.5 kA, 1 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC class for: Wall-standing arrangement</td>
<td>IAC A FLR 31.5 kA, 1 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of accessibility A</th>
<th>Switchgear in closed electrical service location, access “for authorized personnel only” according to IEC 62271-200</th>
</tr>
</thead>
<tbody>
<tr>
<td>– F</td>
<td>Front</td>
</tr>
<tr>
<td>– L</td>
<td>Rear (for free-standing arrangement)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arc test current</th>
<th>31.5 kA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Test duration</th>
<th>1 s</th>
</tr>
</thead>
</table>
Circuit-breaker panels

Outside cone

1) 2615 mm for higher low-voltage compartment

1) Fixing point
2) Floor opening for high-voltage cables
3) Floor opening for control cables

Inside cone

Separate inside cone

1250 A
1600 A
2000 A

Dimensions, front views, sections, floor openings, fixing points for single-busbar switchgear

Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS up to 40.5 kV, Gas-Insulated · Siemens HA 35.51 · 2015
Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS up to 40.5 kV, Gas-Insulated · Siemens HA 35.51 · 2015

**Dimensions**

**Front views, sections, floor openings, fixing points for single-busbar switchgear**

**Disconnecter panels**

**Outside cone**
- 1250 A

**Inside cone**
- 1250 A
- 1600 A
- 2000 A

**Bus sectionalizer**
- 1250 A
- 1600 A
- 2000 A

1) 2615 mm for higher low-voltage compartment

1. Fixing point
2. Floor opening for high-voltage cables
3. Floor opening for control cables
**Dimensions**

Front views, sections, floor openings, fixing points for double-busbar switchgear

Circuit-breaker panels

**Outside cone**

- Dimensions
  - 1250 A
  - 2300 A
  - 2500 A

Inside cone

- Dimensions
  - 1250 A
  - 1600 A
  - 2000 A

Inside cone

- Dimensions
  - 2300 A
  - 2500 A

1) 2615 mm for higher low-voltage compartment

- 1 Fixing point
- 2 Floor opening for high-voltage cables
- 3 Floor opening for control cables
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

1) 2615 mm for higher low-voltage compartment

1 Fixing point
2 Floor opening for high-voltage cables
3 Floor opening for control cables
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

Bus sectionalizers
Busbar system 1

1250 A
1600 A
2000 A

2300 A
2500 A

1) 2615 mm for higher low-voltage compartment

1 Fixing point
3 Floor opening for control cables
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

Bus sectionalizers
Busbar system 2

1250 A
1600 A
2000 A

2300 A
2500 A

1) 2615 mm for higher low-voltage compartment

1 Fixing point
3 Floor opening for control cables
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

Bus sectionalizer consisting of circuit-breaker panel + disconnector panel

1250 A
1600 A
2000 A

2300 A
2500 A
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

Bus couplers

1250 A
1600 A
2000 A

2300 A
2500 A

1) 2615 mm for higher low-voltage compartment

1 Fixing point
3 Floor opening for control cables
Dimensions

Front views, sections, floor openings, fixing points for double-busbar switchgear

Metering panels

1) 2615 mm for higher low-voltage compartment

1 Fixing point
3 Floor opening for control cables
Product Range

Single-busbar panels

Circuit-breaker panel (cable connection as outside cone)

1) Not possible with busbar voltage transformer
2) Requires cable connection with vessel for separate inside cone
3) Not possible with horizontal pressure relief duct

HA35-212/eps

HA35-213/eps

Circuit-breaker panel (cable connection as inside cone)

HA35-213/eps
Product Range

Single-busbar panels

Disconnector panel
(cable connection as outside cone)

Bus sectionalizer

- Busbar current transformer
- Solid-insulated bar
- Voltage transformer, plug-in type
- Voltage transformer, disconnectable
- Current transformer
- Capacitive voltage detecting system
- Surge arrester, plug-in type
- Plug-in cable, 1-to 4-fold, inside-cone interface type 2 or 3 (not included in the scope of supply)
- Cable connection with outside-cone plug (not included in the scope of supply)
- Capacitive voltage detecting system

Disconnector panel
(cable connection as inside cone)

1) Not possible with busbar voltage transformer
3) Not possible with horizontal pressure relief duct
Double-busbar panels

**Product Range**

**Circuit-breaker panel** (cable connection as **outside cone**)

1. Requires cable connection with vessel for separate inside cone
2. Ring-core current transformer, oval design, suitable for use as of 1000 A

**Abbreviations**

- SS1 = Busbar 1
- SS2 = Busbar 2

**Circuit-breaker panel** (cable connection as **inside cone**)

**Abbreviations**

- SS1 = Busbar 1
- SS2 = Busbar 2
Double-busbar panels

Bus sectionalizer

<table>
<thead>
<tr>
<th>SS1</th>
<th>SS2</th>
</tr>
</thead>
</table>

Abbreviations
SS1 = Busbar 1
SS2 = Busbar 2

Bus sectionalizer – circuit-breaker panel
(cable connection as inside cone)

Bus sectionalizer – disconnector panel
(cable connection as inside cone)

Abbreviations
SS1 = Busbar 1
SS2 = Busbar 2

Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS up to 40.5 kV, Gas-Insulated · Siemens HA 35.51 · 2015
Product Range

Double-busbar panels

Abbreviations

SS1 = Busbar 1
SS2 = Busbar 2
**Single-busbar panels**

**Circuit-breaker panel**
- With cable connection as outside cone for
  - Rated voltage up to 36 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars up to 2000 A (2500 A on request), and of feeders up to 1250 A
- With cable connection as inside cone for
  - Rated voltage up to 40.5 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2000 A (2500 A on request)
- With cable connection as separate inside cone for
  - Rated voltage up to 40.5 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2000 A (2500 A on request).

**Disconnector panel**
- With cable connection as outside cone for
  - Rated voltage up to 36 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2000 A (2500 A on request), and of feeders up to 1250 A
- With cable connection as inside cone for
  - Rated voltage up to 40.5 kV
  - Rated short-time withstand current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2000 A (2500 A on request).

**Bus sectionalizer**
- With cable connection as outside cone for
  - Rated voltage up to 36 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2500 A.
- Bus sectionalizer (circuit-breaker panel and disconnector panel)
  - With cable connection as inside cone for
    - Rated voltage up to 36 kV
    - Rated short-circuit breaking current up to 31.5 kA
    - Rated normal currents of busbars and feeders up to 2500 A.

**Bus coupler**
- With cable connection as outside cone for
  - Rated voltage up to 36 kV
  - Rated short-circuit breaking current up to 31.5 kA
  - Rated normal currents of busbars and feeders up to 2500 A.

**Metering panel with a panel spacing of 300 mm or 600 mm**
- With cable connection as outside cone for
  - Rated voltage up to 36 kV
  - Rated normal currents of busbars up to 2500 A.
Single-busbar panel design

Insulating system
- Switchgear vessel filled with SF₆ gas
- Features of SF₆ gas:
  - Non-toxic
  - Odorless and colorless
  - Non-inflammable
  - Chemically neutral
  - Heavier than air
  - Electronegative (high-quality insulator)
- Pressure of SF₆ gas in the switchgear vessel (absolute values at 20 °C):
  - Rated filling level: 150 kPa
  - Design pressure: 180 kPa
  - Design temperature of the SF₆ gas: 80 °C
  - Pickup pressure of the bursting disc: ≥ 300 kPa
  - Bursting pressure: ≥ 550 kPa
  - Gas leakage rate: < 0.1 % p.a.

Panel design
- Factory-assembled, type-tested
- Metal-enclosed, with metallic partitions
  1) Corresponds to “metal-clad” according to former standard IEC 60298
- Hermetically tight, welded switchgear vessel made of stainless steel
- Electrical connections via cast-resin insulated, screened and bolted module couplings
- Maintenance-free
- Degree of protection
  - IP 65 for all high-voltage parts of the primary circuit
  - IP 3XD for the switchgear enclosure
- Vacuum circuit-breaker
- Three-position disconnector for disconnecting and earthing by means of the circuit-breaker
- Make-proof earthing by means of the vacuum circuit-breaker
- Cable connection with outside-cone plug-in system or inside-cone plug-in system according to DIN EN 50181
- Wall-standing or free-standing arrangement
- Installation and possible later extension of existing panels without gas work
- Replacement of the circuit-breaker module without gas work
- Instrument transformers can be removed without altering the position of the busbar and circuit-breaker modules
- Replacement of instrument transformers without gas work, as they are located outside the gas compartments
- Enclosure made of sendzimir-galvanized sheet steel, front and rear side of switchgear as well as end walls powder-coated in color “light basic” (SN 700)
- Low-voltage compartment removable, plug-in bus wires
- Lateral metallic wiring duct for control cables.
Components

Vacuum circuit-breaker

Features

• According to IEC 62271-100 and VDE 0671-100 (for standards, see page 59)
• Application in hermetically welded switchgear vessel in conformity with the system
• Climate-independent vacuum interrupter poles in the SF₆-filled switchgear vessel
• Maintenance-free for indoor installation according to IEC 62271-1 and VDE 0671-1
• Individual secondary equipment
• A metal bellows is used for gasketless separation of the SF₆ insulation and the operating mechanism (already used with success for over 2 million vacuum interrupters).

Trip-free mechanism

The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC 62271 and VDE 0671.

Switching duties and operating mechanisms

The switching duties of the vacuum circuit-breaker are dependent, among other factors, on its type of operating mechanism.

Motor operating mechanism

• Motor operating stored-energy mechanism
  – For auto-reclosing (K)
  – For synchronization and rapid load transfer (U).

Further operating mechanism features

• Located outside the switchgear vessel in the operating mechanism box and behind the control board
• Stored-energy spring mechanism for 10,000 operating cycles.

Operating mechanism functions

Motor operating mechanism ¹) (M1 *)

• In the case of motor operating mechanism, the closing spring is charged by means of a motor and latched in the charged position (“spring charged” indication is visible). Closing is effected either by means of an ON pushbutton or a closing solenoid. The closing spring is recharged automatically (for auto-reclosing).

Endurance class of circuit-breaker

<table>
<thead>
<tr>
<th>Function</th>
<th>Class</th>
<th>Standard</th>
<th>Property of NXPLUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREAKING</td>
<td>M2</td>
<td>IEC 62271-100</td>
<td>10,000 times mechanically without maintenance</td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>IEC 62271-100</td>
<td>10,000 times rated normal current without maintenance</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>IEC 62271-100</td>
<td>50 times short-circuit breaking current without maintenance</td>
</tr>
</tbody>
</table>

Operating times

<table>
<thead>
<tr>
<th></th>
<th>Closing time</th>
<th>Closing solenoid</th>
<th>Opening time</th>
<th>1st release</th>
<th>2nd release</th>
<th>Arcing time at 50 Hz</th>
<th>Break time</th>
<th>1st release</th>
<th>2nd release</th>
<th>Break time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt; 75 ms</td>
<td></td>
<td>&lt; 65 ms</td>
<td>&lt; 50 ms</td>
<td>&lt; 15 ms</td>
<td>&lt; 80 ms</td>
<td>&lt; 65 ms</td>
<td>&lt; 80 ms</td>
<td>&lt; 65 ms</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations for switching duties:

U = Synchronization and rapid load transfer (closing time ≤ 90 ms)
K = Auto-reclosing
1) Motor rating at 60 V to 220 V DC: 700 W
100 V up to 230 V DC: 1100 VA

* Item designation
Secondary equipment
The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application and offers a wide range of possible variations, allowing almost every requirement to be satisfied:

Closing solenoid
• Type 3AY15 10 (Y9 *)
• For electrical closing.

Shunt release
• Types:
  – Standard: 3AY15 10 (Y1 *)
  – Option: 3AX11 01 (Y2 *), with energy store
• Tripping by protection relay or electrical actuation.

Undervoltage release
• Type 3AX11 03 (Y7 *)
• Consisting of:
  – Energy store and unlatching mechanism
  – Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
• Connection to voltage transformers possible.

Anti-pumping (mechanical and electrical)
• Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing. It remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.

Circuit-breaker tripping signal
• For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
• Via limit switch (S6 *) and cutout switch (S7 *).

Varistor module
• To limit overvoltages to approx. 500 V for protection devices (when inductive components are mounted in the vacuum circuit-breaker)
• For auxiliary voltages ≥ 60 V DC.

Auxiliary switch
• Type 3SV9 (S1 *)
• Standard: 6 NO + 6 NC, free contacts thereof 1) 2 NO + 2 NC
• Option: 12 NO + 12 NC, free contacts thereof 1) 8 NO + 8 NC.

Position switch
• Type 3AX4 (S41, S42, S16 *)
• For signaling “closing spring charged”
• For signaling “circuit-breaker blocked”.

Mechanical interlocking
• Mechanical interlocking to the three-position disconnector
• During operation of the three-position switch, the vacuum circuit-breaker cannot be operated.

Possible release combinations

<table>
<thead>
<tr>
<th>Release</th>
<th>Release combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st shunt release type 3AY1510</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>2nd shunt release type 3AX1101</td>
<td>– 1 2 3</td>
</tr>
<tr>
<td>Undervoltage release type 3AX1103</td>
<td>– – 1 2</td>
</tr>
</tbody>
</table>

1) For utilization by the customer
* Item designation

Abbreviations: NO = normally open contact
NC = normally closed contact

Switching rate of the vacuum interrupter

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>Curve 1</th>
<th>Curve 2</th>
<th>Curve 3</th>
<th>Curve 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>12 kV</td>
<td>24 kV</td>
<td>24 kV</td>
<td>36/40.5 kV</td>
</tr>
<tr>
<td>Rated short-circuit-breaking current</td>
<td>31.5 kA</td>
<td>25 kA</td>
<td>25 kA</td>
<td>31.5 kA</td>
</tr>
<tr>
<td>Rated normal current</td>
<td>1250 A</td>
<td>1250 A</td>
<td>2000 A</td>
<td>2500 A</td>
</tr>
</tbody>
</table>

Rated operating sequences
Rapid transfer (U): O-t-CO-t’-CO (t 0.3 s, t’ 3 min)
Auto-reclosing (K): O-t-CO-t’-CO (t 0.3 s, t’ 3 min)
Auto-reclosing (K): O-t-CO-t’-CO (t 0.3 s, t’ 15 s)

O = OPEN operation
CO = CLOSE operation with subsequent OPEN operation at the shortest internal close-open time of the vacuum circuit-breaker
Components

Three-position disconnector

Features of the three-position disconnector
• According to IEC 62271-102 and VDE 0671-102 (for standards, see page 59)
• Application in hermetically welded switchgear vessel in conformity with the system
• Climate-independent contacts in the SF₆-filled switchgear vessel
• Maintenance-free for indoor installation according to IEC 62271-1 and VDE 0671-1
• A metal bellows is used for gasketless separation of the SF₆ insulation and the operating mechanism – as already used with success in millions of vacuum interrupters
• Compact design due to short contact gaps in SF₆ gas
• Operating shaft and contact blades with common center of rotation and reliable switch position up to the operating front of the panel
• 2000 mechanical operating cycles for CLOSED/OPEN
• 1000 mechanical operating cycles for OPEN/READY-TO-EARTH
• Position indication via mechanical coupled indicators
• Separate operating shafts for the “DISCONNECTING” and “READY-TO-EARTH” functions
• Maintenance-free.

Switch positions of the three-position disconnector
“CLOSED”
• Closed current path between busbar and vacuum circuit-breaker
• Contact blades connected with fixed contacts at the busbar bushings

“OPEN”
• Open current path between busbar and vacuum circuit-breaker
• Isolating distances withstand prescribed test voltages

“READY-TO-EARTH”
• Contact blades connected with earth contact of switchgear vessel
• Earthing and short-circuiting the cable connection possible by closing the vacuum circuit-breaker

Endurance class of three-position disconnector

<table>
<thead>
<tr>
<th>Function</th>
<th>Class</th>
<th>Standard</th>
<th>Property of NXPLUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISCONNECTING</td>
<td>M1</td>
<td>IEC 62271-102</td>
<td>2000 times mechanically without maintenance</td>
</tr>
<tr>
<td>READY-TO-EARTH</td>
<td>M0</td>
<td>IEC 62271-102 E0</td>
<td>1000 times mechanically without maintenance</td>
</tr>
<tr>
<td>EARTHING</td>
<td>E2 1)</td>
<td>IEC 62271-200</td>
<td>50 times rated short-circuit making current I&lt;sub&gt;ma&lt;/sub&gt; without maintenance</td>
</tr>
</tbody>
</table>

1) The EARTHING function with endurance class E2 is achieved by closing the circuit-breaker in combination with the three-position disconnector (endurance class E0)
Components

Three-position disconnector

Interlocks

• Selection of permissible switching operations by means of a control gate with mechanically interlocked vacuum circuit-breaker
• Corresponding operating shafts are not released at the operating front until they have been pre-selected with the control gate
• Operating lever cannot be removed until switching operation has been completed
• Circuit-breaker cannot be closed until control gate is in neutral position again
• Switchgear interlocking system also possible with electromechanical interlocks if switchgear is equipped with motor operating mechanisms (mechanical interlocking for manual operation remains).

Switch positions

• “CLOSED”, “OPEN”, “EARTHED” or “READY-TO-EARTH”
• In circuit-breaker panels, earthing and short-circuiting the cable connection is completed by closing the vacuum circuit-breaker.

Operating mechanism

• Slow motion mechanism, used in:
  – Circuit-breaker panel
  – Disconnector panel
  – Bus sectionalizer
  – Bus coupler
• Slow motion mechanism actuated via operating lever at the operating front of the panel
• Separate operating shafts for the DISCONNECTING and EARTHING or READY-TO-EARTH functions
• Option: Motor operating mechanism for the DISCONNECTING and EARTHING or READY-TO-EARTH functions
• Maintenance-free due to non-rusting design of parts subjected to mechanical stress
• Bearings which require no lubrication.

Transmission principle for operating mechanisms

(see illustration)

• Transmission of operating power from outside into the gas-filled switchgear vessel by means of a metal bellows
• Gas-tight
• Maintenance-free.

Transmission principle for operating mechanisms

1 Gas-filled switchgear vessel
2 Gas-tight welded-in metal bellows
**Components**

**Busbar, module coupling**

**Busbar**
- Designed as module coupling
- Solid-insulated
- Interconnects the panels as well as the vessels within a panel.

**Module coupling**
- Single-pole, bolted type
- Consisting of round-bar copper, cast-resin insulated
- Bolted busbar joint, silicone-rubber insulated
- Field control by means of electrically conductive layers on the insulation (inside and outside)
- Screened by earthing the external layers with the switchgear vessel
- Switchgear installation, extension or panel replacement without SF₆ gas work.
Features
- According to IEC 61869-2 and VDE 0414-9-2
- Designed as ring-core current transformers, single-pole
- Flexibility for selecting the mounting location
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Certifiable
- Climate-independent
- Secondary connection by means of a terminal strip in the low-voltage compartment of the panel.

Installation
- Arranged outside the primary enclosure (switchgear vessel)

Mounting locations
- At the busbar (1)
- Between busbar module and circuit-breaker module (2)
- At the panel connection (3)
- Between circuit-breaker module and cable connection module (4)
- Zero-sequence current transformer.

Current transformer types
- Busbar current transformer (1):
  - Inside diameter of transformer 120 mm
  - Max. usable height 170 mm
- Current transformer between busbar module and circuit-breaker module (2):
  - Inside diameter of transformer 120 mm
  - Max. usable height 170 mm
- Current transformer at the panel connection (3):
  - Inside diameter of transformer 120 mm
  - Max. usable height 205 mm
- Current transformer between circuit-breaker module and cable connection module (4):
  - Inside diameter of transformer 120 mm
  - Max. usable height 170 mm
- Zero-sequence current transformer underneath the panels (included in the scope of supply); on-site installation.

Electrical data

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type 4MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>max. 0.8 kV</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage (winding test)</td>
<td>3 kV</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Rated continuous thermal current</td>
<td>max. 1.2 x rated current (primary)</td>
</tr>
<tr>
<td>Rated short-time thermal current, max. 3 s</td>
<td>max. 31.5 kA</td>
</tr>
<tr>
<td>Rated primary current</td>
<td>unlimited, 40 A to 2500 A</td>
</tr>
<tr>
<td>Insulation class</td>
<td>E</td>
</tr>
</tbody>
</table>

Current transformer installation (basic scheme)

1. Current transformer at the busbar
2. Current transformer between busbar module and circuit-breaker module
3. Current transformer at the panel connection
4. Current transformer between circuit-breaker module and cable connection module
Components

Voltage transformers

Features
- According to IEC 61869-3 and VDE 0414-9-3
- Single-pole, plug-in design
- Connection system with plug-in contact
- Inductive type
- Safe-to-touch due to metal enclosure
- Certifiable
- Climate-independent
- Secondary connection by means of plugs inside the panel
- Cast-resin insulated
- Arranged outside the primary enclosure (switchgear vessel)
- Mounting locations:
  - At the busbar on the busbar module (1) (single busbar), or in a separate metering panel (8) (double busbar)
  - At the panel connection (2)(3)(5)

Voltage transformer types
- Busbar voltage transformer 4MT6 (1) on the busbar module (single busbar)
  - Pluggable into an inside-cone socket size 2
  - No separate metering panel required
  - Suitable for 80% of the rated short-duration power-frequency withstand voltage at rated frequency
- Busbar voltage transformer 4MT9 (8) in a separate, 300 mm or 600 mm wide metering panel (double busbar)
  - Connected with the busbar through a flexible cable with inside-cone plug, for connection to the busbar and to the voltage transformer
  - Suitable for 80% of the rated short-duration power-frequency withstand voltage at rated frequency.
• Voltage transformers 4MU1 or 4MT3 (3) at the panel connection of the panels with outside-cone connection
  – Pluggable into an outside-cone bushing at the panel connection
  – Application of type 4MU1 at 36 kV or 24 kV and 31.5 kA
  – Application of type 4MT3 up to 24 kV
  – Disconnectable via a disconnecting facility at the cable connection
  – Switchable through an SF₆-insulated disconnecting facility in the switchgear vessel
  – Positions: “CLOSED” and “Transformer bushing EARTHED”
  – Operation of the disconnecting facility from outside through a metal bellows welded in the switchgear vessel

• Voltage transformers 4MU2 or 4MT5 at the panel connection of the panels with inside-cone connection
  – Connection via an outside-cone bushing at the panel connection for type 4MU2 (2)
  – Connection via a flexible cable between an inside-cone socket at the panel connection and an inside-cone socket at the voltage transformer type 4MU2 (5)
  – Application of type 4MU2 up to 36 kV
  – Application of type 4MT5 up to 40.5 kV.

 Voltage transformer installation for double busbar (basic scheme)

1 Voltage transformer at the panel connection
2 Voltage transformer at the panel connection (inside-cone connection)
3 Voltage transformer at the panel connection (outside-cone connection)
4 Operating lever for disconnecting facility
5 Voltage transformer at the panel connection (separate inside-cone connection)
6 Voltage transformer at the busbar (double-busbar metering panel)
## Electrical data

### Primary data

For types 4MT3, 4MT5, 4MT6, 4MT9, 4MU1 and 4MU2

For operating voltages from 6.0 kV to 38 kV, rated voltage factor $U_n / 8h = 1.9$; $U_n / $continuous = 1.2

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated short-duration power-frequency withstand voltage</th>
<th>Rated lightning impulse withstand voltage</th>
<th>Standard</th>
<th>Operating voltage</th>
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<tr>
<td>kV</td>
<td>kV</td>
<td>kV</td>
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<td>kV</td>
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<td>20</td>
<td>60</td>
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<td>6.0 $\sqrt{3}$; 6.24 $\sqrt{3}$; 6.3 $\sqrt{3}$; 6.6 $\sqrt{3}$; 6.9 $\sqrt{3}$</td>
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<tr>
<td>12</td>
<td>28</td>
<td>75</td>
<td>IEC</td>
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<td>95</td>
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<td>125</td>
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<td>170</td>
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### Secondary data

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<tr>
<th>For type</th>
<th>Operating voltage</th>
<th>Auxiliary winding</th>
<th>Thermal limit current (measuring winding) A</th>
<th>Rated long-time current 8 h A</th>
<th>Rating at accuracy class</th>
<th>VA</th>
<th>VA</th>
<th>VA</th>
<th>VA</th>
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<td>4MT6</td>
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<td>120 $\sqrt{3}$</td>
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<td>4MT9</td>
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<td>120 $\sqrt{3}$</td>
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<td>IEC</td>
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<td>4MU1</td>
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<td>100 $\sqrt{3}$</td>
<td>110 $\sqrt{3}$</td>
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<td>4MU2</td>
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<td>120 $\sqrt{3}$</td>
<td>6</td>
<td>6</td>
<td>IEC</td>
</tr>
</tbody>
</table>
Components
Horizontal pressure relief duct

Design
• Modular design per panel
• Various elements for flexible design of the evacuation
• Pressure flap insertion element for wall penetration (masonry opening).

Dimensions
• Height of switchgear panel
  Single busbar: 2874 mm
  Double busbar: 2997 mm
• Minimum room height
  Single busbar: 2950 mm
  Double busbar: 3100 mm
• See dimensions of evacuation elements on the next page.

Tests
• Type-tested design.

Installation
• The horizontal pressure relief duct on the panel is installed on site
• Evacuation elements according to constructional planning.

Evacuation to the left
(also possible to the right)
Evacuation to the rear
Components

Horizontal pressure relief duct, dimensions

NXPLUS DBB with horizontal pressure relief duct and evacuation

Evacuation to the left (also possible to the right)

Evacuation to the rear

Elements for the evacuation duct
### Components

#### Panel connection with outside cone

**Features**

- For circuit-breaker panel 1250 A, for disconnector panel 1250 A
- Bushings with outside cone
- With bolted contact (M16) as interface type “C” according to EN 50180/EN 50181
- Cable connection height 591 mm
- Max. connection depth: 960 mm with standard cable compartment cover
- With cable bracket, type C40 according to DIN EN 50024
- Option: Access to cable compartment only if the feeder is isolated and earthed
- For thermoplastic-insulated cables
- For shielded cable T-plugs or cable elbow plugs with bolted contact
- For connection cross-sections up to 800 mm²
- Larger cross-sections on request
- Cable routing downwards, cable connection from the front
- For rated normal currents up to 1250 A
- Cable T-plugs are not included in the scope of supply.

**Surge arresters**

- Pluggable on cable T-plug
- Surge arresters recommended if, at the same time,
  - the cable system is directly connected to the overhead line,
  - the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear.

**Surge limiters**

- Pluggable on cable T-plug
- Surge limiters recommended when motors with starting currents < 600 A are connected.

### Connectable cables

**Cable T-plug with coupling insert**

- Connection with 1 cable per phase
- Connection with 2 cables per phase
- Connection with 3 cables per phase

**Cable T-plug with coupling T-plug**

- Connection with 2 cables per phase
- Connection with 3 cables per phase

**Solid-insulated bar**

- 1 Cable T-plug
- 2 Coupling T-plug
- 3 Screw-type coupling insert
- 4 End adapter
## Components

### Panel connection with outside cone (commercially available cable plugs and bar connections)

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Cable sealing end</th>
<th>Cross-section mm²</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thermoplastic-insulated cables 12 kV according to IEC 60502-2 and VDE 0276-620</strong></td>
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<tr>
<td>1-core cable, PE and XLPE-insulated, N2YSY (Cu) and N2XSX (Cu) or NA2YS (A) and NA2XS (A)</td>
<td>Euromold</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>430TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>440TB/G</td>
<td>400 to 630</td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>489TB/G</td>
<td>400 to 630</td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>500 to 630</td>
<td></td>
<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td></td>
<td>800 to 1200</td>
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<td>EPDM with semi-conductive layer</td>
</tr>
<tr>
<td>nkt cables</td>
<td>CB 12-630</td>
<td>25 to 300</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<tr>
<td></td>
<td>CB 17.5-630</td>
<td>25 to 500</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
</tr>
<tr>
<td></td>
<td>CB 36-630(1250)</td>
<td>25 to 500</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<tr>
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<td>CB 42-1250-3</td>
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<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<tr>
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<td>SET 12</td>
<td>50 to 300</td>
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<td>SEHDT 13</td>
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<tr>
<td>Tyco Electronics/Raychem</td>
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<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<td>RSTI-395xx</td>
<td>400 to 800</td>
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<tr>
<td>ABB Kabeldon</td>
<td>CSE-A 12630-xx</td>
<td>25 to 630</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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<tr>
<td><strong>Thermoplastic-insulated cables 24 kV according to IEC 60502-2 and VDE 0276-620</strong></td>
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<tr>
<td>1-core cable, PE and XLPE-insulated, N2YSY (Cu) and N2XSX (Cu) or NA2YS (A) and NA2XS (A)</td>
<td>Euromold</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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<td>K400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
</tr>
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<td>K430TB/G</td>
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<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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<td>K440TB/G</td>
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<td>K489TB/G</td>
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<td>CB 36-630(1250)</td>
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<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<td>RSTI-395xx</td>
<td>400 to 800</td>
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<td>25 to 630</td>
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<td><strong>Thermoplastic-insulated cables 36 kV according to IEC 60502-2 and VDE 0276-620</strong></td>
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<tr>
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<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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## Components

### Panel connection with outside cone (commercially available cable plugs and bar connections)

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Cable sealing end</th>
<th>Make</th>
<th>Type</th>
<th>Cross-section mm²</th>
<th>Comment</th>
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<tbody>
<tr>
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<td>Euromold</td>
<td>M400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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<tr>
<td>3-core cable, paper insulated ASB and ASBL</td>
<td></td>
<td>Euromold</td>
<td>400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
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<tr>
<td>nkt cables</td>
<td>CB 36-630</td>
<td>25 to 300</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<tr>
<td>SÜdkabel</td>
<td>SET 36 SEHDT 33</td>
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<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with distribution kit</td>
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<tr>
<td>Tyco Electronics Raychem</td>
<td>RSTI-66xx</td>
<td>25 to 300</td>
<td>Silicone with semi-conductive layer, with capacitive measuring point, in combination with distribution kit RSTI-TRFox</td>
<td></td>
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</tr>
<tr>
<td>ABB Kabeldon</td>
<td>CSE-A 36630-xx</td>
<td>25 to 630</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper-insulated belted cables (non-draining cables) ≤ 12 kV according to IEC 60055 and VDE 0255</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3-core cable, paper insulated NKBA (Cu), NKBY (Cu), NKRA (Cu) and NKFA (Cu) or NAKBA (Al), NAKBY (Al), NAKRA (Al) and NAKFA (Al)</td>
<td></td>
<td>Euromold</td>
<td>400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
</tr>
<tr>
<td>3-core cable, paper insulated ASB and ASBL</td>
<td></td>
<td>Euromold</td>
<td>400TB/G</td>
<td>35 to 300</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
</tr>
<tr>
<td>nkt cables</td>
<td>CB 36-630</td>
<td>25 to 240</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with transition sealing end type SÜEV 10</td>
<td></td>
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<tr>
<td>SÜdkabel</td>
<td>SP 33</td>
<td>25 to 300</td>
<td>Silicone with semi-conductive layer (optionally with metal housing), in combination with transition sealing end type SÜEV 10</td>
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<td>Tyco Electronics Raychem</td>
<td>RSTI-66xx</td>
<td>25 to 300</td>
<td>Silicone with semi-conductive layer, with capacitive measuring point, in combination with distribution kit</td>
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</tr>
<tr>
<td>ABB Kabeldon</td>
<td>CSE-A 36630-xx</td>
<td>25 to 630</td>
<td>EPDM with semi-conductive layer, in combination with distribution kit</td>
<td></td>
<td></td>
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<tr>
<td>Surge-proof caps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make</td>
<td>Type</td>
<td>Size</td>
<td>Rated voltage</td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>Outside-cone plug-in system according to EN 50181</td>
<td>3M</td>
<td>SP 33</td>
<td>Outside cone type “C”</td>
<td>12 kV</td>
<td>Silicone with semi-conductive layer</td>
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<tr>
<td>Nexans</td>
<td>Euromold</td>
<td>400DR-B</td>
<td>Outside cone type “C”</td>
<td>12 kV</td>
<td>EPDM with semi-conductive layer</td>
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<tr>
<td>nkt cables</td>
<td>CBC 40.5-630</td>
<td>CBC 40.5-630</td>
<td>Outside cone type “C”</td>
<td>12 kV</td>
<td>Silicone with semi-conductive layer</td>
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<tr>
<td>Südkabel</td>
<td>SP 33</td>
<td>SP 33</td>
<td>Outside cone type “C”</td>
<td>12 kV</td>
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### Commercially available bar systems

<table>
<thead>
<tr>
<th>Bar type</th>
<th>Bar connection</th>
<th>Make</th>
<th>Type</th>
<th>Conductor material</th>
<th>Max. rated current</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Solid-insulated bar</td>
<td></td>
<td>Moser Glaser</td>
<td>Duresca DE</td>
<td>Aluminum</td>
<td>1250 A</td>
<td>Outer sheath made of polyamide (polyamide tube)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DE</td>
<td>Copper</td>
<td>1250 A</td>
<td>Outer sheath made of CuNi steel or aluminum (metal sheath)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DG</td>
<td>Aluminum</td>
<td>1250 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DG</td>
<td>Copper</td>
<td>1250 A</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Preissinger</td>
<td>ISOBUS MR</td>
<td>Aluminum</td>
<td>1250 A</td>
<td>Outer sheath made of heat shrinkable tube; insulated with cast-resin impregnated paper bandage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>COPPER</td>
<td>Copper</td>
<td>1250 A</td>
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</table>
## Components

### Installation possibilities with outside cone for cable connections and surge arresters

<table>
<thead>
<tr>
<th>Number of cables per panel and phase</th>
<th>Make</th>
<th>Rated voltage (kV)</th>
<th>Conductor cross-section (mm²)</th>
<th>Insulation</th>
<th>Cable T-plugs</th>
<th>Coupling inserts/coupling plugs</th>
<th>Surge arresters with coupling inserts</th>
<th>According to standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nexans Euromold</td>
<td>12</td>
<td>25 to 300</td>
<td>35 to 300</td>
<td>50 to 240</td>
<td>EPDM</td>
<td>1x 400TB/G</td>
<td>–</td>
</tr>
<tr>
<td>12</td>
<td>ABB</td>
<td>24</td>
<td>25 to 300</td>
<td>35 to 300</td>
<td>50 to 240</td>
<td>EPDM</td>
<td>1x 430TB/G</td>
<td>1x K400TB/G</td>
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<tr>
<td>36</td>
<td>Südkabel</td>
<td>12</td>
<td>400 to 630</td>
<td>400 to 630</td>
<td>300 to 630</td>
<td>EPDM</td>
<td>1x 440TB/G</td>
<td>1x K440TB/G</td>
</tr>
<tr>
<td>12</td>
<td>Tyco Electronics Raychem</td>
<td>24</td>
<td>50 to 630</td>
<td>35 to 630</td>
<td>35 to 630</td>
<td>EPDM</td>
<td>1x 484TB/G</td>
<td>1x K484TB/G</td>
</tr>
<tr>
<td>2</td>
<td>ABB Kabeldon</td>
<td>24</td>
<td>800 to 1200</td>
<td>800 to 1200</td>
<td>800 to 1200</td>
<td>EPDM</td>
<td>1x 498TB/G</td>
<td>1x K498TB/G</td>
</tr>
</tbody>
</table>

1) Observe the actual current and short-current carrying capacity of the cables and the sealing ends.

---

44 Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS up to 40.5 kV, Gas-Insulated - Siemens HA 35.51 - 2015
## Components

### Installation possibilities with outside cone for cable connections and surge arresters

<table>
<thead>
<tr>
<th>Number of cables per panel and phase</th>
<th>Make</th>
<th>Rated voltage kV</th>
<th>Conductor cross-section mm²</th>
<th>Insulation</th>
<th>Cable T-plugs</th>
<th>Coupling inserts/coupling plugs</th>
<th>Surge arresters with coupling inserts</th>
<th>Coupling inserts</th>
<th>According to standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>nkt cables</td>
<td>12</td>
<td>25 to 300</td>
<td>Silicone</td>
<td>1x CB 12-630</td>
<td>1x CC 12-630</td>
<td>CSA 12-x</td>
<td>–</td>
<td>IEC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>25 to 300</td>
<td>Silicone</td>
<td>1x CB 12-630</td>
<td>1x CC 12-630</td>
<td>CSA 12-x</td>
<td>–</td>
<td>IEC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>25 to 300</td>
<td>Silicone</td>
<td>1x CB 12-630</td>
<td>1x CC 12-630</td>
<td>CSA 12-x</td>
<td>–</td>
<td>IEC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 to 300</td>
<td>1250</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GB / DL for China</td>
</tr>
<tr>
<td>12</td>
<td>Raychem</td>
<td>25 to 300</td>
<td>1250</td>
<td>Elkabylon</td>
<td>3x CB 12-630</td>
<td>3x K80TB/G</td>
<td>RSTI-CC-125x</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 to 300</td>
<td>1250</td>
<td>Elkabylon</td>
<td>3x CB 12-630</td>
<td>3x K80TB/G</td>
<td>RSTI-CC-125x</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 to 300</td>
<td>35 to 300</td>
<td>Silicone</td>
<td>1x RSTI-58xx</td>
<td>1x RSTI-CC-58xx</td>
<td>RSTI-CC-58Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 to 630</td>
<td>1250</td>
<td>Silicone</td>
<td>1x RSTI-58xx</td>
<td>1x RSTI-CC-58xx</td>
<td>RSTI-CC-58Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
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<tr>
<td></td>
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<td>40 to 800</td>
<td>1250</td>
<td>Silicone</td>
<td>1x RSTI-58xx</td>
<td>1x RSTI-CC-58xx</td>
<td>RSTI-CC-58Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 to 630</td>
<td>1250</td>
<td>Silicone</td>
<td>1x RSTI-58xx</td>
<td>1x RSTI-CC-58xx</td>
<td>RSTI-CC-58Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 to 800</td>
<td>1250</td>
<td>Silicone</td>
<td>1x RSTI-58xx</td>
<td>1x RSTI-CC-58xx</td>
<td>RSTI-CC-58Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
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<tr>
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<td></td>
<td>630 to 1000</td>
<td>1250</td>
<td>Silicone</td>
<td>1x CB 42-1250-3</td>
<td>1x CC 42-2500-3</td>
<td>RSTI-CC-68Sxxx</td>
<td>IECE</td>
<td>GB / DL for China</td>
</tr>
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</table>

1) Observe the actual current and short-current carrying capacity of the cables and the sealing ends.

**Fixed-Mounted Circuit-Breaker Switchgear Type NXPLUS up to 40.5 kV, Gas-Insulated · Siemens HA 35.51 · 2015**
Components
Panel connection with inside-cone plug-in system or solid-insulated bar

Features
- For circuit-breaker and disconnector panels
- Inside-cone plug-in system according to DIN EN 50181
- For connection cross-sections up to 630 mm²
- Up to 4 cables with inside-cone plug size 2
- Up to 3 cables with inside-cone plug size 3
- With cable bracket, type C40 according to DIN EN 50024
- Option: Access to the cable compartment only if the feeder has been isolated and earthed
- For thermoplastic-insulated cables
- Cable routing downwards, cable connection from the front
- Inside-cone plugs are not part of the scope of supply
- Additionally one outside-cone termination (up to 36 kV) or one inside-cone socket (40.5 kV) for connection of a voltage transformer
- Instead of an inside-cone plug, the cable connection can also be designed for a solid-insulated bar.

Surge arresters
- Inside-cone sockets can be equipped with a surge arrester instead of an inside-cone cable plug
- Surge arresters are available for plug-in sockets size 2 or 3
- Surge arresters are available with discharge currents of 5 kA and 10 kA.
**Components**

Panel connection with inside cone (commercially available cable plugs and bar connections)

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Cable sealing end</th>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Cross-section mm²</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoplastic-insulated cables ≤ 12 kV according to IEC 60502-2 and VDE 0276-620</td>
<td></td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tool</td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>50 to 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Südkabel</td>
<td>SEIK 14</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEIK 15</td>
<td>3</td>
<td>120 to 630</td>
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Thermoplastic-insulated cables ≤ 24 kV according to IEC 60502-2 and VDE 0276-620

<table>
<thead>
<tr>
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<th>Cable sealing end</th>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Cross-section mm²</th>
<th>Comment</th>
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</thead>
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<tr>
<td>Thermoplastic-insulated cables ≤ 24 kV according to IEC 60502-2 and VDE 0276-620</td>
<td></td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tool</td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>50 to 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>3</td>
<td>50 to 300</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Südkabel</td>
<td>SEIK 24</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
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<tr>
<td></td>
<td></td>
<td>SEIK 25</td>
<td>3</td>
<td>50 to 630</td>
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Thermoplastic-insulated cables ≤ 36 kV according to IEC 60502-2 and VDE 0276-620

<table>
<thead>
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<th>Cable sealing end</th>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Cross-section mm²</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoplastic-insulated cables ≤ 36 kV according to IEC 60502-2 and VDE 0276-620</td>
<td></td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tool</td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>25 to 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
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<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>3</td>
<td>95 to 630</td>
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<tr>
<td></td>
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<td>2</td>
<td>35 to 300</td>
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<tr>
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<td>SEIK 35</td>
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Commercially available bar systems

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<thead>
<tr>
<th>Bar type</th>
<th>Bar connection</th>
<th>Make</th>
<th>Type</th>
<th>Conductor material</th>
<th>Max. rated current</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid-insulated bar</td>
<td></td>
<td>MGC Moser Glaser</td>
<td>Duresca DE</td>
<td>Aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of polyamide (polyamide tube)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DE</td>
<td>Copper</td>
<td>2500 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DG</td>
<td>Aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of CrNi steel or aluminum (metal sheath)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duresca DG</td>
<td>Copper</td>
<td>2500 A</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Preissinger</td>
<td>ISOBUS MR</td>
<td>Aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of heat shrinkable tube; insulated with cast-resin impregnated paper bandage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISOBUS MR</td>
<td>Copper</td>
<td>2500 A</td>
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</table>

Surge-proof caps

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Rated voltage</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>nkt cables</td>
<td>FPI 2</td>
<td>Inside cone size 2</td>
<td>40.5 kV</td>
<td>Silicone with metal cover</td>
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<tr>
<td></td>
<td>FPI 3</td>
<td>Inside cone size 3</td>
<td>40.5 kV</td>
<td>Silicone with metal cover</td>
</tr>
<tr>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>Inside cone size 2</td>
<td>40.5 kV</td>
<td>Silicone with metal cover</td>
</tr>
<tr>
<td></td>
<td>CONNEX</td>
<td>Inside cone size 3</td>
<td>40.5 kV</td>
<td></td>
</tr>
<tr>
<td>Südkabel</td>
<td>ISK 14</td>
<td>Inside cone size 2</td>
<td>12 kV</td>
<td>Silicone with metal cover</td>
</tr>
<tr>
<td></td>
<td>ISK 24</td>
<td>Inside cone size 2</td>
<td>24 kV</td>
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</tr>
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<td></td>
<td>ISK 34</td>
<td>Inside cone size 2</td>
<td>40.5 kV</td>
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</tr>
<tr>
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<td>ISK 15</td>
<td>Inside cone size 3</td>
<td>12 kV</td>
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</tr>
<tr>
<td></td>
<td>ISK 25</td>
<td>Inside cone size 3</td>
<td>24 kV</td>
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<tr>
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<td>ISK 35</td>
<td>Inside cone size 3</td>
<td>40.5 kV</td>
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</tbody>
</table>
### Components

#### Installation possibilities with inside cone for cable connections and surge arresters

<table>
<thead>
<tr>
<th>Number of cables per panel and phase</th>
<th>Size of inside-cone plug-in system</th>
<th>Make</th>
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1) Observe the actual current and short-current carrying capacity of the cables and the sealing ends.

- Circuit-breaker panel 1250 A
- Circuit-breaker panel 1600 A
- Circuit-breaker panel 2000 A
- Circuit-breaker panel 2300 A
- Circuit-breaker panel 2500 A
- Disconnector panel 1250 A
- Disconnector panel 1600 A
- Disconnector panel 2000 A
### Components

**Installation possibilities with inside cone for cable connections and surge arresters**

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<th>Size of inside-cone plug-in system</th>
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1) Observe the actual current and short-current carrying capacity of the cables and the sealing ends.

• Circuit-breaker panel 1250 A • Circuit-breaker panel 1600 A • Circuit-breaker panel 2000 A • Circuit-breaker panel 2300 A
• Circuit-breaker panel 2500 A • Disconnector panel 1250 A • Disconnector panel 1600 A • Disconnector panel 2000 A
Indicators and detecting systems

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Symptoms:
- **A0**: CAPDIS-S2+: Operating voltage not present
- **A1**: Operating voltage present
- **A2**: – Operating voltage not present, – for CAPDIS-S2+: auxiliary power not present
- **A3**: Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
- **A4**: Voltage (not operating voltage) present
- **A5**: Indication “Test” passed
- **A6**: Indication: “Test” not passed (lights up briefly)
- **A7**: Overvoltage present (lights up permanently)
- **A8**: Indication “ERROR”, e.g. in case of missing auxiliary voltage

Indicating and measuring equipment

Voltage detecting systems according to IEC 61243-5 or VDE 0682-415, or IEC 62271-206 or VDE 0671-206 (WEGA ZERO)

- To verify safe isolation from supply
- LRM detecting systems
  - with integrated indicator
  - with integrated indicator, type VOIS+, VOIS R+; WEGA ZERO
- with integrated indicator, with integrated repeat test of the interface, with integrated function test, type CAPDIS-S1+, WEGA 1.2, WEGA 1.2 Vario, with integrated signaling relay, type CAPDIS-S2+, WEGA 2.2.

Plug-in voltage indicator

- Verification of safe isolation from supply phase by phase
- Indicator suitable for continuous operation
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes if high voltage is present.

VOIS+, VOIS R+

- Integrated display, without auxiliary power
- With indication “A1” to “A3” (see legend)
- Maintenance-free, repeat test required
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (only VOIS R+)
- Degree of protection IP54.

Common features CAPDIS-Sx

- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” pushbutton
- Adjustable for different operating voltages (adjustable capacity C2)
- With integrated 3-phase LRM test socket for phase comparison
- With connectable signal-lead test
- With overvoltage monitoring and signaling (1.2 times operating voltage)
- Degree of protection IP54.

CAPDIS-S1+

- Without auxiliary power
- With indication “A1” to “A7” (see legend)
- Without ready-for-service monitoring
- Without signaling relay (without auxiliary contacts).

CAPDIS-S2+

- With indication “A0” to “A8” (see legend)
- Only by pressing the “Display Test” pushbutton: “ERROR” indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (auxiliary power required)
- With integrated signaling relay for signals (auxiliary power required).

Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth

\[
U_{E} = U_{N}/\sqrt{3} \quad \text{during rated operation in the three-phase system}
\]

\[
U_{2} = U_{E} \times \text{Voltage at the capacitive interface of the switchgear or at the voltage indicator}
\]
### Components

**Indicating and measuring equipment**

#### WEGA ZERO
- Voltage detecting system according to IEC 62271-206 or VDE 0671-206
- With indication “A1” to “A4” (see legend)
- Maintenance-free
- With integrated 3-phase test socket for phase comparison
- Degree of protection IP54.

#### WEGA 1.2, WEGA 1.2 Vario
- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication “A1” to “A5” (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- Without integrated signaling relay
- Without auxiliary power
- Degree of protection IP54
- Adjustable for different operating voltages (adjustable capacitance C2 – only for WEGA 1.2 Vario).

#### WEGA 2.2
- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication “A0” to “A6” (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (auxiliary power required)
- Degree of protection IP54.

#### Symbols shown
- LC display gray: not illuminated
- LC display white: illuminated

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<th>WEGA ZERO</th>
<th>WEGA 1.2</th>
<th>WEGA 1.2 Vario</th>
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**Voltage indication**

via capacitive voltage divider (principle)
- $U_{LE} = \frac{U_N}{\sqrt{3}}$ during rated operation in the three-phase system
- $U_2 = U_A$: Voltage at the capacitive interface of the switchgear or at the voltage indicator

**Indications and test modes**

- **A0** For WEGA 2.2:
  - Operating voltage not present, auxiliary power present, LCD illuminated
- **A1** Operating voltage present
  - For WEGA 2.2: Auxiliary power present, LCD illuminated
- **A2** Operating voltage not present
  - For WEGA 2.2: Auxiliary power not present, LCD not illuminated
- **A3** Failure in phase L1, operating voltage at L2 and L3
  - For WEGA 2.2: Auxiliary power present, LCD illuminated
- **A4** Voltage present, current monitoring of coupling section below limit value
  - For WEGA 2.2: Auxiliary power present, LCD illuminated
- **A5** Indication “Dispaly Test” passed
  - For WEGA 2.2: Auxiliary power present, LCD illuminated
- **A6** For WEGA 2.2: LCD for missing auxiliary voltage is not illuminated

---

**Diagrams and Symbols**

- **Integrated voltage indicator WEGA ZERO**
- **Integrated voltage detecting system WEGA 1.2, WEGA 1.2 Vario**
- **Integrated voltage detecting system WEGA 2.2**

---

**Voltage indication via capacitive voltage divider (principle)**

- $C_1$: Capacitance integrated into bushing
- $C_2$: Capacitance of the connection leads and the voltage indicator to earth

\[
U_{LE} = \frac{U_N}{\sqrt{3}}
\]

\[
U_2 = U_A : \text{Voltage at the capacitive interface of the switchgear or at the voltage indicator}
\]
Components

Indicating and measuring equipment

Verification of correct terminal-phase connections
• Verification of correct terminal-phase connections possible by means of a phase comparison test unit (can be ordered separately)
• Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear.

Phase comparison test units according to IEC 61243-5 or VDE 0682-415

- Phase comparison test unit make Pfisterer, type EPV as combined test unit (HR and LRM) for
  - Voltage detection
  - Phase comparison
  - Interface test
  - Integrated self-test
  - Indication via LED

- Phase comparison test unit make Kries, type CAP-Phase as combined test unit (HR and LRM) for
  - Voltage detection
  - Phase comparison
  - Phase sequence test
  - Self-test
  - The unit does not require a battery.

- Phase comparison test unit make Horstmann, type ORION 3.1 as combined test unit (HR and LRM) for
  - Phase comparison
  - Interface testing at the switchgear
  - Voltage detection
  - Integrated self-test
  - Indication via LED and acoustic alarm
  - Phase sequence indicator

- Phase comparison test unit make Hachmann, type VisualPhase LCD as combined test unit (HR and LRM) for
  - Voltage detection with measured-value indication
  - Interface test
  - Undervoltage detection
  - Documentable repeat test
  - Phase comparison with LED signal and measured-value indication
  - Phase angle from –180° to +180°
  - Phase sequence evaluation
  - Frequency quality
  - Complete self-test
Ready-for-service indicator
- Self-monitoring; easy to read
- Independent of temperature and pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Signaling switch, 1 changeover contact, for remote electrical indication.

Mode of operation
For the ready-for-service indicator, a gas-tight measurement box is installed inside the switchgear vessel. A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside signaling switch through the non-magnetizable switchgear vessel. Then, the armature activates the proximity switch. While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switchgear. The temperature effect is compensated via the same pressure change in both gas volumes.

Indication
- Signaling switches -S41..S44 are wired to the binary input of the bay controller
- Indication as "panel" group signal at the bay controller
- "Substation" group signal is transferred to the telecontrol system.

NXDENS (option)
- Signaling switches -S41..S44 are wired to the NXDENS indicator
- Indication as "panel" status message on NXDENS indicator
- Green status LED Panel is ready for service
- Red status LED Panel is not ready for service
- If the status LED lights up red, missing service readiness can be spatially assigned to the individual module vessels through the LEDs 1...4
- The spatially correct assignment is supported by suitable pictograms at the switchgear front
- Signaling relays are available for signaling and monitoring of each module vessel (telecontrol system)
- "Life" signaling relay monitors proper operation of NXDENS (telecontrol system)
- The "Test" key is used for checking proper operation of the red LED
- The crank generator (below the status LEDs) allows for short-time checking of service readiness, even if the auxiliary voltage supply is missing. Here, the individual signaling relays remain in OPEN position, i.e., no signal to telecontrol system
- Auxiliary voltage 100 V to 230 V AC, 24 V to 220 V DC (wide-range power supply unit).
Components

Indicating and measuring equipment

Low-voltage compartment

- For accommodation of protection, control, measuring and metering equipment
- Partitioned safe-to-touch from the high-voltage part of the panel
- Low-voltage compartment can be removed, bus wires and control cables are plugged in
- Option: Higher low-voltage compartment (1100 mm instead of von 935 mm) possible.
Protecting, controlling and monitoring are the basic requirements placed on a complete bay controller across all technology generations. The properties the user expects from modern bay controllers are: multifunctionality, reliability, safety and communication capability. The increasing integration of many functions in one multifunctional device leads to an optimally supported engineering process, IT security, service and testability, or simple and safe operability of the devices and tools. On the following pages you will find functional descriptions for some selected devices. The low-voltage compartment can accommodate all customary protection, control, measuring and monitoring equipment available on the market:

Overview of the device types of the SIPROTEC device series: SIPROTEC 5, SIPROTEC Compact and SIPROTEC 4

### SIPROTEC 5

<table>
<thead>
<tr>
<th>Protection, control, measuring and monitoring equipment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcurrent protection with PMU, control and power quality</td>
<td>7SJ82, 7SJ85</td>
</tr>
<tr>
<td>Distance protection with PMU and control</td>
<td>7SA84, 7SA86, 7SA87</td>
</tr>
<tr>
<td>Line differential protection with PMU and control</td>
<td>7SD84, 7SD86, 7SD87</td>
</tr>
<tr>
<td>Combined line differential and distance protection with PMU and control</td>
<td>7SL86, 7SL87</td>
</tr>
<tr>
<td>Circuit-breaker management device with PMU and control</td>
<td>7VK87</td>
</tr>
<tr>
<td>Overcurrent protection for lines</td>
<td>7SJ86</td>
</tr>
<tr>
<td>Transformer protection with PMU, control, monitoring</td>
<td>7UT85, 7UT86, 7UT87</td>
</tr>
<tr>
<td>Motor protection with PMU</td>
<td>7SK82, 7SK85</td>
</tr>
<tr>
<td>Central busbar protection</td>
<td>7SS85</td>
</tr>
<tr>
<td>Bay controllers for control/interlocking tasks with PMU and monitoring, optionally with protection functions</td>
<td>6MD85, 6MD86</td>
</tr>
<tr>
<td>Digital fault recorder</td>
<td>7KE85</td>
</tr>
</tbody>
</table>

### SIPROTEC Compact

<table>
<thead>
<tr>
<th>Protection, control, measuring and monitoring equipment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcurrent protection</td>
<td>7SJ80, 7SJ81</td>
</tr>
<tr>
<td>Motor protection</td>
<td>7SK80, 7SK81</td>
</tr>
<tr>
<td>Voltage and frequency protection</td>
<td>7RW80</td>
</tr>
<tr>
<td>Line differential protection</td>
<td>7SD80</td>
</tr>
<tr>
<td>Distribution system controller</td>
<td>7SC80</td>
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</tbody>
</table>

### SIPROTEC 4

<table>
<thead>
<tr>
<th>Protection, control, measuring and monitoring equipment</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Overcurrent protection</td>
<td>EASY 7SJ45/7SJ46, 7SJ600, 7SJ601, 7SJ602, 7SJ61, 62, 63, 64</td>
</tr>
<tr>
<td>Distance protection</td>
<td>7SA522, 7SA6</td>
</tr>
<tr>
<td>Line differential protection</td>
<td>7SD600, 7SD610, 7SD52, 53</td>
</tr>
<tr>
<td>Transformer differential protection</td>
<td>7UT612, 613, 63</td>
</tr>
<tr>
<td>Busbar protection</td>
<td>7SS60, 7SS522, 7SS52</td>
</tr>
<tr>
<td>Generator and motor protection</td>
<td>7UM61, 7UM62, 7VE6, 7UM518</td>
</tr>
<tr>
<td>Accessories for generator and motor protection</td>
<td>7UW50; 7XR, 3PP, 7KG61, 7XT, 4NC</td>
</tr>
<tr>
<td>Rapid changeover device</td>
<td>7VU683</td>
</tr>
<tr>
<td>Bay controllers</td>
<td>6MD61, 6MD63, 6MD662, 663, 664, 6MB825</td>
</tr>
<tr>
<td>U/f relay</td>
<td>7RW600</td>
</tr>
<tr>
<td>Transient earth-fault relay</td>
<td>7SN600</td>
</tr>
<tr>
<td>Breaker failure protection</td>
<td>7SV600</td>
</tr>
<tr>
<td>Automatic reclosing, synchrocheck</td>
<td>7VK61</td>
</tr>
<tr>
<td>High-impedance protection</td>
<td>7VH60</td>
</tr>
</tbody>
</table>
Protection, control, measuring and monitoring equipment

SIPROTEC 5 device series

- Powerful automation with graphical CFC (Continuous Function Chart)
- Secure serial protection data communication, also over large distances and all available physical media (fiber-optic cable, 2-wire connections and communication networks)
- Recognition of static and transient earth faults (passing contact function in resonant-earthed and isolated systems)
- Measurement of operational values
- Phasor Measurement Unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Powerful fault recording
- Control of switching devices.

Overcurrent protection device SIROTEC 7SJ82

- Directional and non-directional time-overcurrent protection with additional functions
- Time optimization of the tripping times by directional comparison and protection data communication
- Frequency protection and rate-of-frequency-change protection for load shedding applications
- Overvoltage and undervoltage protection in all required variations
- Power protection, configurable as active or reactive power protection
- Control, synchrocheck and system interlocking
- Firmly integrated electrical Ethernet port J for DIGSI
- Complete IEC 61850 (reporting and GOOSE) via integrated port J
- Two optional, pluggable communication modules usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, DNP3 (serial+TCP), Modbus RTU Slave, protection data communication).

Distance protection SIPROTEC 7SA86

- Line protection for all voltage levels with 3-pole tripping
- Very short tripping time
- Selective protection of overhead lines and cables with single- and multi-ended infeeds
- Time-graded backup protection to differential protection relays
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Main protection function: 6-system distance protection
- Detection of current transformer saturation for fast tripping with high accuracy at the same time.

Differential protection SIPROTEC 7SD86

- Line protection for all voltage levels with 3-pole tripping
- Phase-selective protection of overhead lines and cables with single- and multi-ended infeeds of all lengths with up to 6 line ends
- Transformers and shunt reactors within the protection zone are possible
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Protection of lines with capacitive series compensation
- Directional backup protection and various additional functions.
Transformer differential protection SIPROTEC 7UT85
- Transformer differential protection for two-winding transformers with versatile additional protection functions
- Universal utilization of the permissible measuring points
- Flexible adjustment to the transformer vector group, controlling of making and overexcitation processes, secure performance in case of current transformer saturation with different saturation degrees.
- Protection of standard power transformers and autotransformers
- Increased sensitivity in case of earth short-circuits close to the neutral point by means of a separate earth-fault differential protection
- Additional current and voltage inputs can be provided for standard protection functions such as overcurrent, voltage, frequency, etc.
- In the standard version, two communication modules can be plugged in, and different protocols can be used (IEC 61850, IEC 60870-5-103, DNP3 (serial, TCP), Modbus RTU Slave).

Motor protection SIPROTEC 7SK82
- Motor protection functions: start-time supervision, thermal overload protection for stator and rotor, restart inhibit, unbalanced load protection, load-jump protection
- Stator and bearing temperature monitoring via a temperature sensor with an external RTD box
- Directional and non-directional time-overcurrent protection (short-circuit protection) with additional functions
- Overvoltage and undervoltage protection in all required variations
- Power protection, configurable as active or reactive power protection
- Control, synchrocheck and switchgear-interlocking system
- Firmly integrated electrical Ethernet port J for DIGSI
- Complete IEC 61850 (reporting and GOOSE) via integrated port J
- Two optional, pluggable communication modules usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, DNP3 (serial+TCP), Modbus RTU Slave, protection data communication).

Digital fault recorder SIPROTEC 7KE85
- Fast-scan recorder
- Up to 2 slow scan recorders
- Up to 5 continuous recorders
- Usable as Phasor Measurement Unit (PMU) according to IEEE C37.118 Standard
- Transfer of recordings and triggering via IEC 61850
- Variable sampling rates programmable between 1 kHz – 16 kHz
- No-loss data compression
- Time synchronization via IRIG-B, DCF77 and SNTP
- Free mapping of measured values to the individual recorders
- Free combination of measuring groups for power calculation
- Quality bits for displaying the momentary channel quality
- The trigger functions of a function block are the fundamental value, r.m.s. value, zero-sequence, positive-sequence, negative-sequence system, Σ active, Σ reactive and Σ apparent power
- Level trigger and gradient trigger for each trigger function
- Flexible cross and network trigger
- Creation of trigger functions with the graphical automation editor CFC (Continuous Function Chart)
- Trigger functions by combination of single signals, double signals, analog values, binary signals, Bool signals and GOOSE messages.
SIPROTEC Compact series
Overcurrent protection SIPROTEC 7SJ80
• Pluggable current and voltage terminals
• Binary input thresholds settable using DIGSI (3 stages)
• Secondary current transformer values (1A/5A)
  settable using DIGSI
• 9 programmable function keys
• 6-line display
• Buffer battery exchangeable from the front
• USB front port
• 2 additional communication ports
• IEC 61850 with integrated redundancy (electrical or optical)
• Relay-to-relay communication through Ethernet with
  IEC 61850 GOOSE
• Millisecond-accurate time synchronization through
  Ethernet with SNTP.

SIPROTEC 4 series
Overcurrent and motor protection SIPROTEC 7SJ61 / 7SJ62
• For stand-alone or master operation
• Communications and bus capability
• Functions: Protection, control, signaling, communication
  and measuring
• LC text display (4 lines) for process and equipment data,
  as text, e.g. for
  – Measuring and metering values
  – Information on status of switchgear and switching device
  – Protection data
  – General indications
  – Alarms
• Four freely programmable function keys for frequently
  performed functions
• Seven freely programmable LEDs for displaying
  any desired data
• Keys for navigation in menus and for entering values
• Fault recorder.

Overcurrent and motor protection SIPROTEC 7SJ63
• For stand-alone or master operation
• Communications and bus capability
• Functions: Protection, control, signaling, communication
  and measuring
• LC display for process and equipment data in the form of
  a feeder control diagram and as text, e.g. for
  – Measuring and metering values
  – Information on status of switchgear and switching device
  – Protection data
  – General indications
  – Alarms
• Four freely programmable function keys for frequently
  performed functions
• Fourteen freely programmable LEDs for displaying
  any desired data
• Two key-operated switches to switch between “local
  and remote control” and “interlocked and non-interlocked
  operation”
• Keys for navigation in menus and for entering values
• Integrated motor control by special relays with enhanced
  performance
• Fault recorder.
Type of service location
NXPLUS switchgear can be used as indoor installation according to IEC 61936 (Power Installations exceeding AC 1 kV) and VDE 0101

- outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.
- in lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering. Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

Terms
- “Make-proof earthing switches” are earthing switches with short-circuit making capacity according to
  - IEC 62271-102 and
  - VDE 0671-102/EN 62271-102.

Standards
NXPLUS switchgear complies with the relevant standards and specifications applicable at the time of type tests. In accordance with the harmonization agreement reached by the countries of the European Union, their national specifications conform to the IEC standard.

Overview of standards (May 2015)

<table>
<thead>
<tr>
<th>Category</th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgear</td>
<td>NXPLUS</td>
<td>IEC 62271-1</td>
<td>VDE 0671-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 62271-200</td>
<td>VDE 0671-200</td>
</tr>
<tr>
<td>Devices</td>
<td>Circuit-breakers</td>
<td>IEC 62271-100</td>
<td>VDE 0671-100</td>
</tr>
<tr>
<td></td>
<td>Disconnectors and earthing switches</td>
<td>IEC 62271-102</td>
<td>VDE 0671-102</td>
</tr>
<tr>
<td></td>
<td>Voltage detecting systems</td>
<td>IEC 61243-5</td>
<td>VDE 0682-415</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP code</td>
<td>IEC 60529</td>
<td>VDE 0470-1</td>
</tr>
<tr>
<td></td>
<td>IK code</td>
<td>IEC 62262</td>
<td>VDE 0470-100</td>
</tr>
<tr>
<td>Insulation</td>
<td>–</td>
<td>IEC 60071</td>
<td>VDE 0111</td>
</tr>
<tr>
<td>Instrument transformers</td>
<td>–</td>
<td>IEC 61869-1</td>
<td>VDE 0414-9-1</td>
</tr>
<tr>
<td></td>
<td>Current transformers</td>
<td>IEC 61869-2</td>
<td>VDE 0414-9-2</td>
</tr>
<tr>
<td></td>
<td>Voltage transformers</td>
<td>IEC 61869-3</td>
<td>VDE 0414-9-3</td>
</tr>
<tr>
<td>Installation, erection</td>
<td>–</td>
<td>IEC 61936-1</td>
<td>VDE 0101</td>
</tr>
<tr>
<td>Insulating gas SF₆</td>
<td>Specification for new SF₆</td>
<td>IEC 60376</td>
<td>VDE 0373-1</td>
</tr>
</tbody>
</table>

Table – Dielectric strength

<table>
<thead>
<tr>
<th>Rated voltage (r.m.s. value)</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage (r.m.s. value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across isolating distances</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
</tr>
<tr>
<td>– Between phases and to earth</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (peak value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across isolating distances</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
</tr>
<tr>
<td>– Between phases and to earth</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
<td>kV</td>
</tr>
</tbody>
</table>

Dielectric strength

- The dielectric strength is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 62271-1/VDE 0671-1 (see table "Dielectric strength").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11g/m³ humidity according to IEC 60071 and VDE 0111).

The gas insulation at a relative gas pressure of 50 kPa permits switchgear installation at any desired altitude above sea level without the dielectric strength being adversely affected. This also applies to the cable connection when plug-in sealing ends are used.
Standards

Standards, specifications, guidelines

Current carrying capacity
• According to IEC 62271-200 or IEC 62271-1, VDE 0671-200 or VDE 0671-1, the rated normal current refers to the following ambient air temperatures:
  – Maximum of 24-hour mean + 35 °C
  – Maximum + 40 °C
• The current carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosure.

Internal arc classifications
• Protection of operating personnel by means of tests for verifying the internal arc classification
• Internal arcing tests must be performed in accordance with IEC 62271-200 or VDE 0671-200
• Definition of criteria:
  – Criterion 1: Correctly secured doors and covers do not open, limited deformations are accepted
  – Criterion 2: No fragmentation of the enclosure, no projection of small parts above 60 g
  – Criterion 3: No holes in accessible sides up to a height of 2 m
  – Criterion 4: No ignition of indicators due to hot gases
  – Criterion 5: The enclosure remains connected to its earthing point.

Resistance to internal faults
Due to the single-pole enclosure of external components and the SF₆ insulation of switching devices, the possibility of faults in SF₆-insulated switchgear is improbable and a mere fraction of that typical of earlier switchgear types:
• There are no effects due to external influences, such as
  – Pollution layers
  – Humidity
  – Small animals and foreign objects
• Maloperation is practically excluded due to logical arrangement of operating elements
• Short-circuit-proof feeder earthing by means of the circuit-breaker.
In the unlikely event of a fault within the switchgear housing, the energy conversion in the case of an internal arc fault is minor thanks to the SF₆ insulation and the shorter length of the arc – approximately only ⅓ of the converted energy of an arc in air insulation. The escaping gases are discharged upwards through a pressure relief duct.

Seismic withstand capability (option)
NXPLUS single-busbar switchgear can be upgraded for regions at risk from earthquakes. For upgrading, earthquake qualification testing has been carried out in accordance with the following standards:
• IEC 60068-3-3, 1993
• IEC 60068-2-6, 1995.
For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:
• Uniform Building Code Zone 3
• Seismic Requirements Spec. 9067;
  Department of Water & Power, Los Angeles
• GTS – 1.013 ENDESA, Chile
• VDE 0670-111.

Color of the panel front
Siemens standard (SN) 47 030 G1, color no. 700 / light basic (similar to RAL 7047 / telegray).

Climate and environmental influences
NXPLUS switchgear is completely enclosed and insensitive to climatic influences.
• All medium-voltage devices are installed in a gas-tight, welded stainless-steel switchgear vessel which is filled with SF₆ gas
• Live parts outside the switchgear vessel are provided with single-pole enclosure
• At no point can creepage currents flow from high-voltage potentials to earth
• Operating mechanism parts which are functionally important are made of corrosion-resistant materials
• Bearings in the operating mechanism are designed as dry-type bearings and do not require lubrication.

The NXPLUS switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1.
• Temperature –5 °C up to +55 °C
• Realative air humidity Mean value over 24 hours: ≤ 98 %
  Mean value over 1 month: ≤ 90 %
• Condensation Occasionally
  Frequently (degree of protection min. IP31D, with anti-condensation heater in the low-voltage part)
• Site altitude No restriction
Furthermore, the high-voltage part of NXPLUS switchgear can be used in environmental conditions of the climatic category 3C2 according to the standard IEC 60721-3-3.

Protection against solid foreign objects, electric shock and water
NXPLUS switchgear fulfills according to the standards IEC 62271-1 VDE 0671-1, EN 62271-1
IEC 62271-200 VDE 0671-200, EN 62271-200
IEC 60529 VDE 0470-1, EN 60529
IEC 62262 VDE 0470-100, EN 50102
the following degrees of protection:

<table>
<thead>
<tr>
<th>Degree of protection IP</th>
<th>Type of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP 6S</td>
<td>for parts of the primary circuit under high voltage</td>
</tr>
<tr>
<td>IP 3XD</td>
<td>for switchgear enclosure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of protection IK</th>
<th>Type of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>IK 07</td>
<td>for switchgear enclosure</td>
</tr>
</tbody>
</table>

For secondary devices in the low-voltage door, the stipulations of the IP degree of protection apply according to the definitions for the switchgear enclosure.

1) Secondary devices (e.g. protection devices, meters, measuring transducer etc.) must be suitable for the given operating conditions
2) Heater in the low-voltage compartment and operating mechanism box of the circuit-breaker
Notes